Test Project

Task C1 – Mechanical maintenance in water and wastewater treatment plan

Pump maintenance

Water Technology

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Introduction

Maintenance task C1 consists of workshop-based tasks related to the inspection and servicing of a centrifugal pump. During these tasks, it is essential to adhere to the safety protocols which include the mandatory use of the Personal Protective Equipment (PPE).

The following components are provided for your task:

- Extension Kit EDS Pump Station WorldSkills 2026 Shanghai
- Tools for this task

Note: All necessary spare parts are included with the extension kit. Use only the components required to fulfill this task.

Description of project and tasks

At a municipal water treatment plant, treated drinking water is transferred from the clear-water reservoir to the distribution network by pressure-boosting pumps. These pumps help maintain the pressure required to supply homes, businesses, and elevated storage tanks reliably across the service area.

Since these pumps operate regularly under pressure, several components are exposed to continuous mechanical and hydraulic loading. One (1) of these components is the shaft seal, which prevents water from leaking along the rotating pump shaft.

During a routine inspection, traces of leakage were observed near the shaft seal area of one (1) high-pressure multistage centrifugal pump. A leaking shaft seal cannot be ignored, as it can lead to water loss, hygiene concerns, reduced operating reliability, and unplanned maintenance if left unresolved.

The affected pump has therefore been taken out of operation and brought to the maintenance workshop for inspection and repair. The pump has already been in operation for some time, and the cartridge mechanical seal shows signs of wear. Before the pump can be accepted again as a reliable unit, the cartridge mechanical seal must be replaced, and the pump must be reassembled correctly.

The task is limited only to the inspection of the pump, the replacement of the cartridge mechanical seal, and the checks required to complete the workshop service.

Initial Situation

A centrifugal pump has been removed from service after leakage was reported near the shaft seal area. The pump is now available in the maintenance workshop and must be inspected before the repair work begins.

The cartridge mechanical seal is the suspected source of the leakage. You as technician shall open the pump only as far as required to access and replace the cartridge mechanical seal. The hydraulic section of the pump, including the impellers, stage casings, liner, and pump housing, is not part of this task and must not be disassembled or modified.

Before starting the repair, you should carry out the required safety checks, inspect the pump for visible damage, and identify the relevant components. After replacing the cartridge mechanical seal, the pump shall be reassembled correctly and checked for completeness, correct orientation, and service readiness.

The completed work and any observations shall be recorded in the pump service protocol.

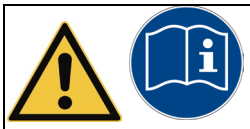
Tasks

Your task is to carry out the workshop maintenance of the centrifugal pump. This includes preparing the pump for safe work, inspecting it, replacing the cartridge mechanical seal, reassembling it correctly, and documenting the completed work in the pump service protocol.

The repair scope is limited to the cartridge mechanical seal and the components that must be removed to access it. Do not disassemble the hydraulic section, impellers, stage casings, liner, or pump housing.

After completing the task, confirm whether the pump is service-ready.

Safety and Protective Equipment



Be aware of the hazards associated with pump maintenance and handling.

Keep the operating instructions and pump service protocol available at the workstation.

Read the pump service protocol carefully before starting the task.

Warnings



Risk of crushing hands



Warning of the risk of tipping over when rolling



Risk of falling objects

Mandatory PPE

Wear head protection



Wear safety shoes



Wear protective clothing



Wear protective gloves



Wear eye protection



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Instructions to the Competitor

Pump Description

Description of the components of the Wilo Pump: See **Figure 1**.

NO.	DESCRIPTION
[1]	Motor connection bolt
[2]	Coupling guard
[3]	Cartridge - Mechanical seal
[4]	Hydraulic stage casing
[5]	Impeller
[6]	Pump shaft
[7]	Motor
[8]	Coupling
[9]	Lantern
[10]	Liner
[11]	Flange
[12]	Pump housing
[13]	Base plate

Safety checks before starting

Before working on the pump, confirm that:

- All required PPE is worn
- The workstation, tools and replacement seal are complete and undamaged. Report anything missing or damaged before starting

Important: *Do not disassemble the hydraulics, impellers, stage casing, liner or pump housing. Only the components needed to reach and replace the cartridge mechanical seal may be removed.*

Overview of the task

Carry out the work in phases, following the numbered protocol in the table below:

Phase 1 – Preparation: Prepare the work area, remove the pump from its transport box, inspect it, and secure it to the mounting plate. (step 1–4)

Phase 2 – Disassembly: Remove the coupling guards, coupling, motor and lantern, then release and withdraw the cartridge mechanical seal (steps 11–18).

Phase 3 – Seal replacement: Fit the new cartridge mechanical seal, supplied pre-assembled with its spacer.

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Phase 4 – Reassembly: Refit the lantern, cartridge, coupling, motor and coupling guards, tightening fasteners evenly in a crosswise pattern (steps 21–28).

Phase 5 – Function check: Confirm the shaft rotates freely, without noise, friction or resistance, before completing the Task Form.

Note: When releasing the set screws that secure the shaft, only loosen them — never remove them completely. Tighten the cartridge and seal screws evenly in a crosswise pattern to avoid distortion.

When all steps are complete, fill in the Task Form and confirm whether the pump is service-ready.

Pump Service Protocol

Use the table below to carry out the Task C1: replacing the cartridge mechanical seal on the Wilo multistage vertical centrifugal pump and returning the pump to a service-ready condition.

Work through the protocol below in the order shown. For every step, tick the "Done" column and record any measurement, observation or remark in the "Note/observation/result" column.

Pump Model no.:	_____	**Order No.**	**WorldSkills 2026**
No.	**Activity**	**Done**	**Note/observation/result**
0	***Unpacking the Pump and preparation of the workbench***	☐	
1	Carefully remove the pump from its packaging. The extension kit also has spare parts supplied. Check that there is no visible transport damage.	☐	
2	Use the crane and provide slings to lift the pump safely out of the box. Place the pump on the workbench as shown in **Figure 2**. If the ***crane*** is not available for this task, you can lift the pump to move it on the bench. **If the Pump is too heavy to move, please call the technical support for assistance.**	☐	
3	For this task, mount the pump on the mounting plate to ensure stability during the maintenance work. The mounting plate is also required later to assemble the pump in the station. ↳ See **Figure 3** *Hint: The image here is only for reference purposes. Look at the flow direction before mounting.*	☐	

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4	Before tightening the pump to the mounting plate, check the flow direction. The flow direction is indicated by an arrow on the pump housing. Make sure that the pump is mounted in the correct orientation as shown in the **Figure 3** and **Figure 4.** *Note that the mounting holes on the mounting plate are not positioned in the center.* *Hint: When viewed from the front, the discharge side of the pump must face the left side of the mounting plate.*	☐	
10	***Disassembly of the Cartridge (mechanical)***		
11	First, loosen the screws on the coupling guards (on both sides). See **Figure 5**. - Check for the spacer attached to the designated bracket on the lantern. ↳ See **Figure 18**. **If this is missing, please call the technical support personnel.**	☐	
12	Loosen the 2 screws on the coupling, (1 on each side) **Figure 6**.	☐	
13	Loosen the four existing mounting screws (two (2) on each side) on the motor and remove them completely. See **Figure 7**. The motor can now be removed. See **Figure 8**.	☐	
14	Loosen the 4 screws holding the lantern and unscrew them completely. See **Figure 9**. The lantern can now be removed. Follow the indications on the right in **Figure 9**.	☐	
15	To remove the mechanical seal, the set screws securing the shaft must be loosened. See **Figure 10**. *Note: The mechanical seal on this pump is provided as a package and is referred to as Cartridge from here on.* *Important: Only loosen them; do not remove them completely!*	☐	
16	You can now loosen the four screws on the cartridge and unscrew them. ↳ See **Figure 11** (to the left).	☐	
17	To push the cartridge out of its housing, you must use the two (2) ejection holes. To do this, screw the provided screws into the designated threads and	☐	

	tighten them evenly. ↳ See **Figure 11** (to the right).		
18	You can now carefully loosen and lift the cartridge with a flat head screwdriver and pull it straight upwards to remove it. ↳ See **Figure 12** for guidance. *At this point, please do not dissemble the Hydraulic casing. This is not necessary for replacing the mechanical seal.* ***Note:** Do not drop any screws or tiny parts inside the Hydraulic casing.*	☐	
20	***Reassembly of the Cartridge (mechanical seal) – steps***		
21	The mechanical seal comes pre-assembled with a spacer. **Figure 13** shows Old and New Cartridge. The replacement cartridge comes with a spacer attached. Now slide this straight onto the shaft and secure it in place using the screws.	☐	
22	Now tighten the lock screws. ↳ See **Figure 14** for the steps (1, 2, 3, 4). Tighten the screws in a crosswise pattern, *taking care to avoid twisting them!* *Note: Place the spacer only after tightening these 3 screws.*	☐	
23	Slide the lantern onto the shaft from above and screw in all mounting screws (x4), then tighten them. - Step 1 — slide the Lantern. - Step 2 — tighten the four screws. ↳ See **Figure 16** (to the left). *Note: Make sure that the lantern is mounted correctly (There is a ridge below to indicate this).*	☐	
24	As the cartridge is supplied pre-assembled with a spacer, it should now be fitted in this position. If the spacer has been removed, the shaft mounting must be lifted **evenly** together with the shaft and the spacer inserted. This is located on the side of the lantern. See **Figure 15** and **Figure 16** (to the right).	☐	
25	Once raised, the shaft must now be secured by coupling. To do this, tighten the two (2) screws. See **Figure 16** (to the right).	☐	

	Note: Remove the spacer to check whether the shaft rotates freely and without noise, friction, or resistance! *You can rotate it with your hand to check this.*		
26	The motor can then be refitted. - Step 1 — Align the Motor shaft to match the Lantern. - Step 2 — Mount the motor on to the Lantern. - Step 3 — Tighten the 4 screws attaching the Motor and the Lantern. ↳ See **Figure 17** for reference.	☐	
27	The spacer can now be removed. Make sure that both the spacers are still there, 1. The one in the designated mounting bracket on the lantern is there. ↳ See **Figure 18** 2. The additional spacer supplied with the replacement cartridge can be put back on the old cartridge.	☐	
28	Finally, mount both the coupling guards back. ↳ See **Figure 19**	☐	
30	Leave the Pump mounted on the mounting plate on the workbench after finishing the reassembly. Place the old cartridge in the cover and put back all the unused components inside the supplied box of the Extension kit including the additional spacer.	☐	
Date and finish time	_____	**Carried out by:**	Country: _____ Competitor: _____

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To continue.

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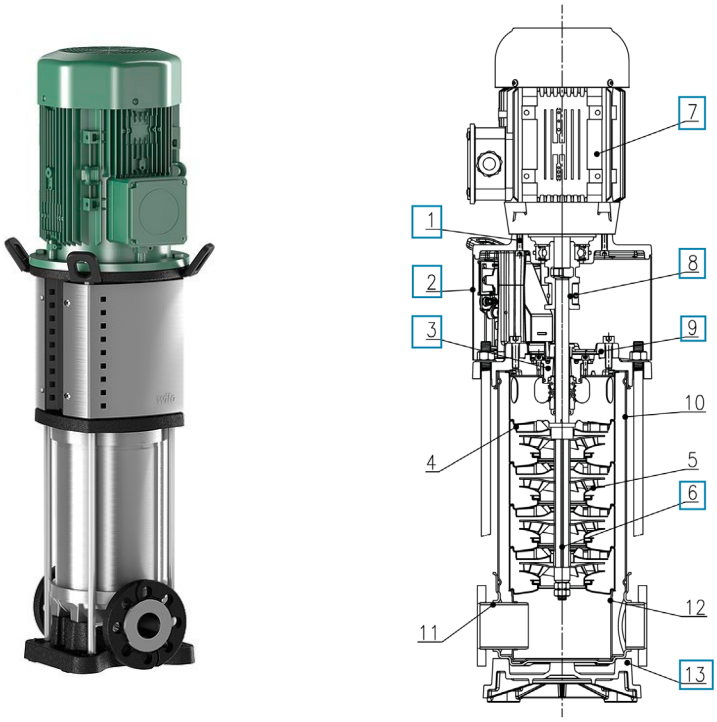


Figure 1 Description of the pump components (see the description under Instructions section).

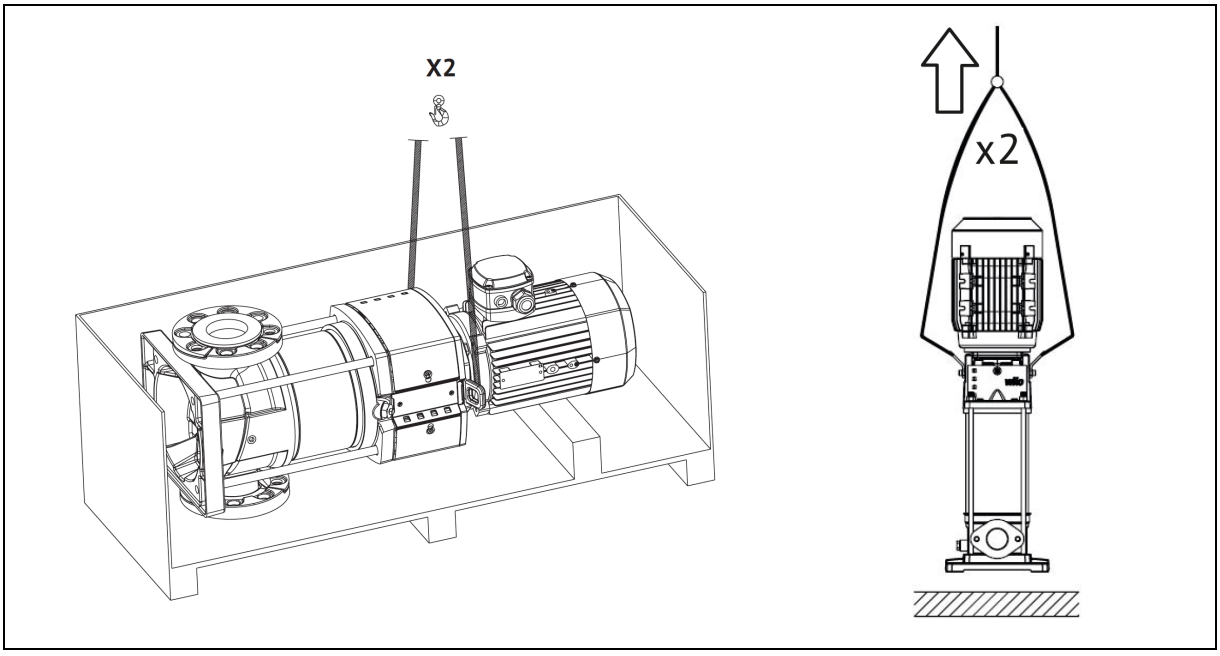


Figure 2 Slinging points on the Pump.

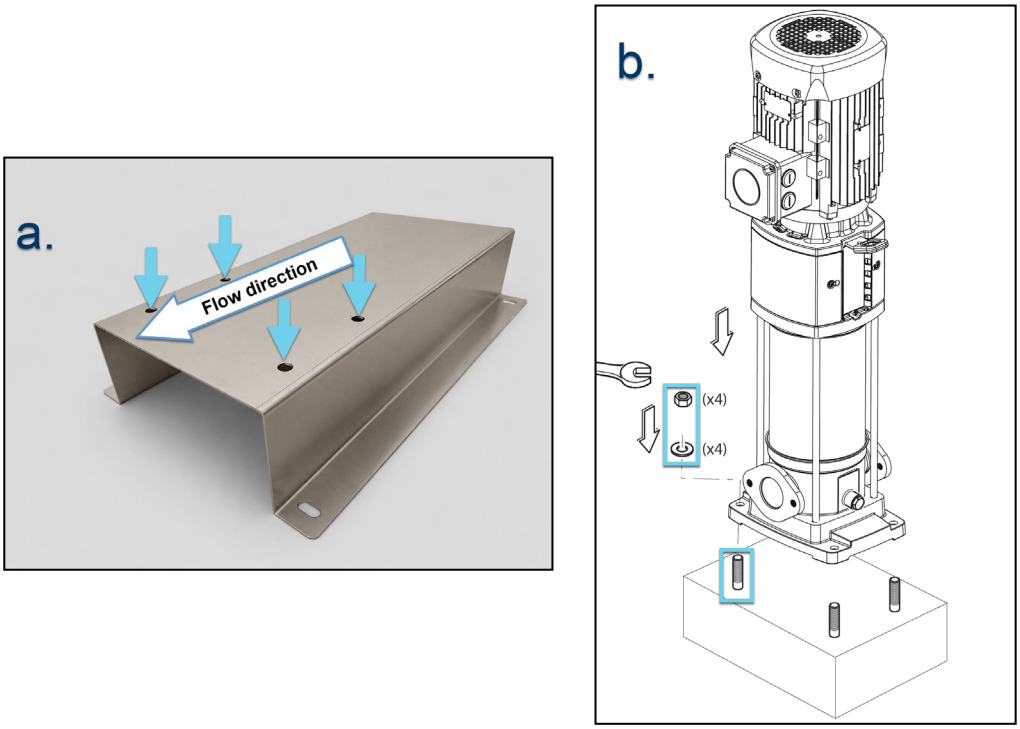


Figure 3 a: Mounting plate (bolting points); **b:** Mounting the Pump (only reference).

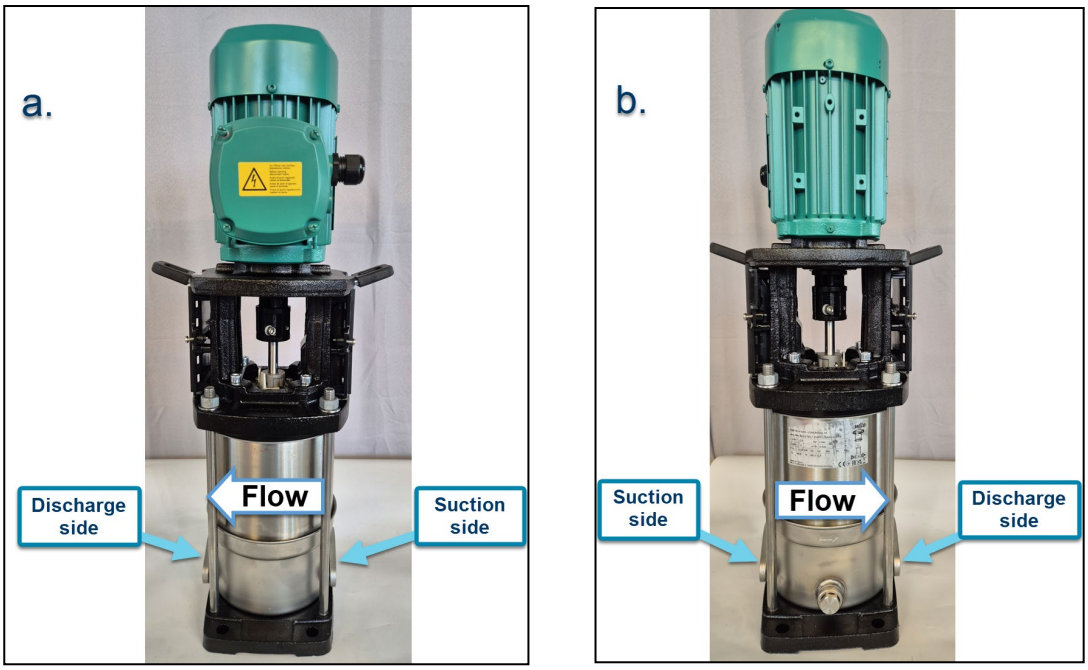


Figure 4 a: Front view of the Pump **b:** Rear view of the Pump (Flow direction is indicated).

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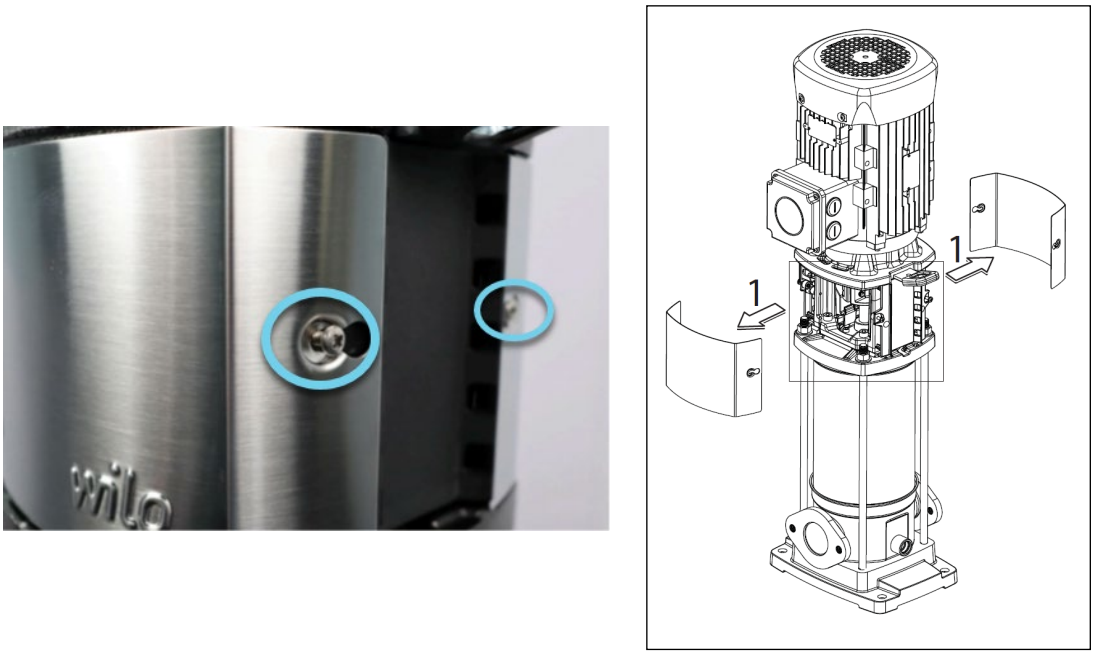


Figure 5 Coupling guards (x4 screws).

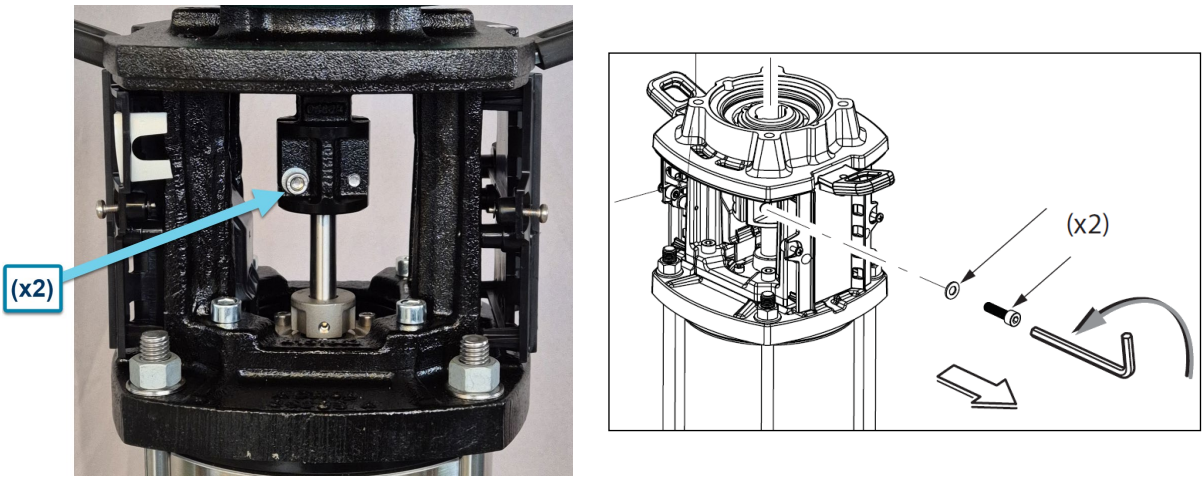


Figure 6 Unscrewing points on the Coupling.

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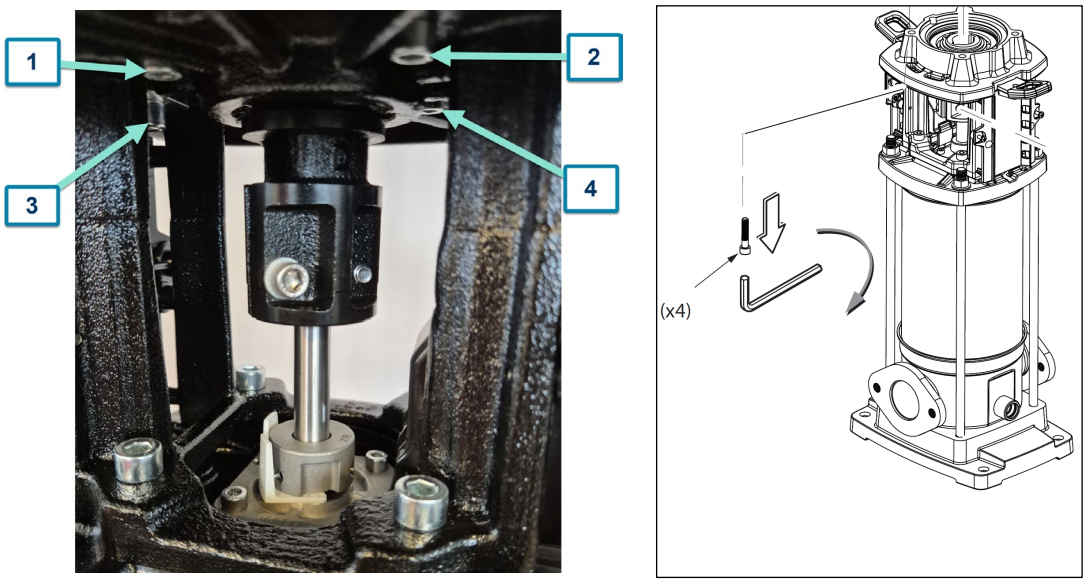


Figure 7 Mounting screws holding the motor.

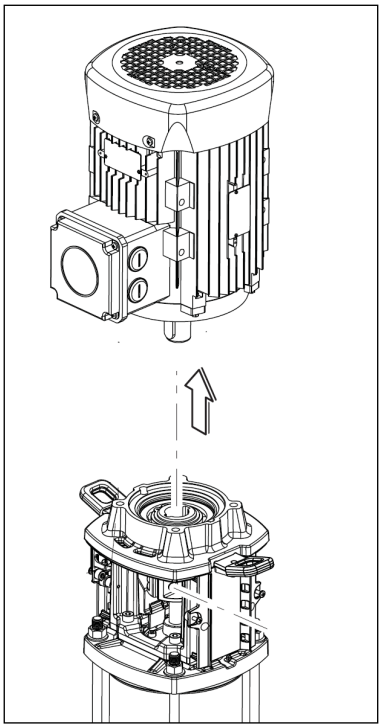


Figure 8 Removing the motor.

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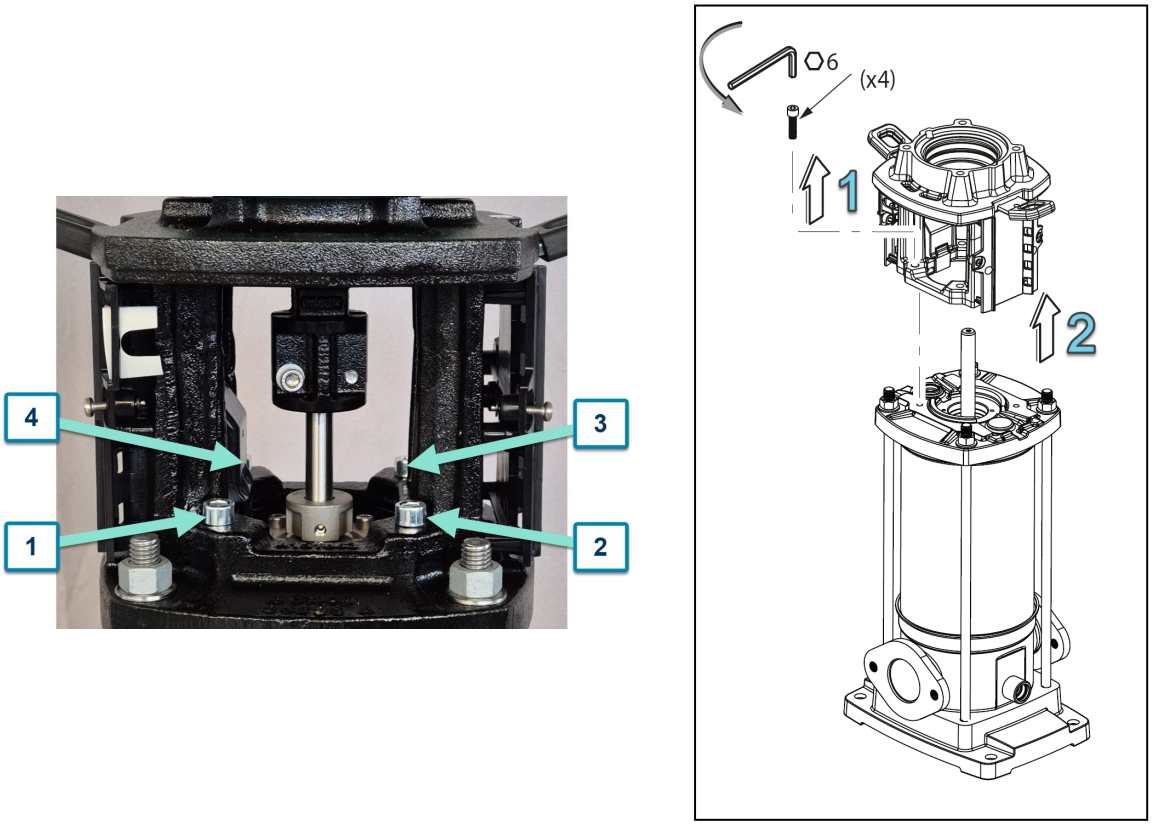


Figure 9 Lantern screws and removal of the Lantern.

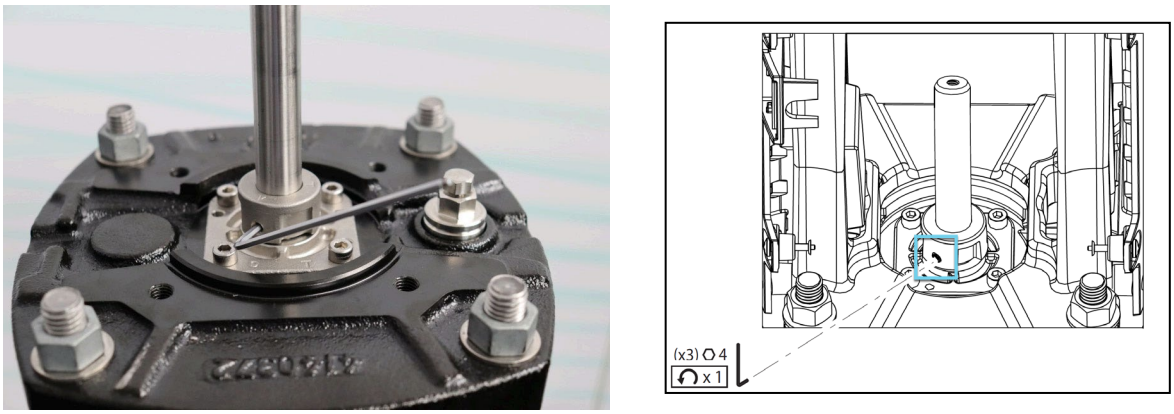


Figure 10 Cartridge holding to the shaft (x3 screws).



Figure 11 Cartridge (Unscrewing points x4); Ejection holes (to lift the Cartridge).

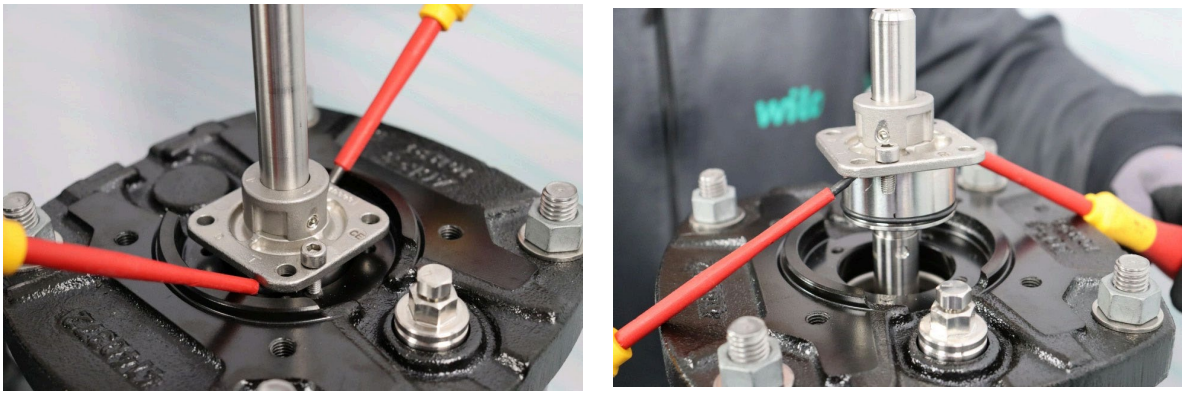


Figure 12 Removal of the Cartridge.



Figure 13 Old Cartridge; New Cartridge (comes with a spacer attached).

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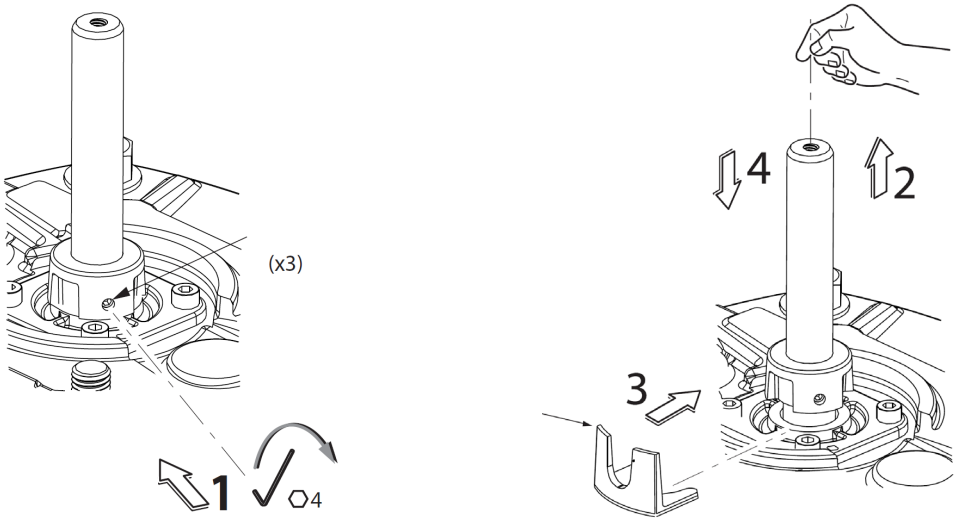


Figure 14 Assembling the replacement Cartridge.

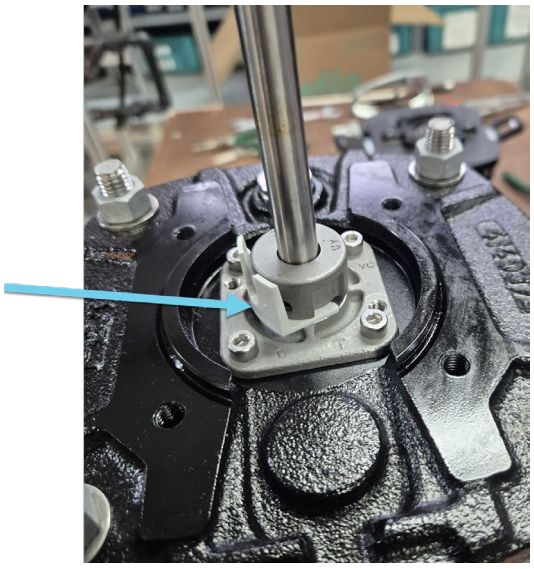


Figure 15 Inserting the spacer (Only after tightening the shaft screws on the cartridge).

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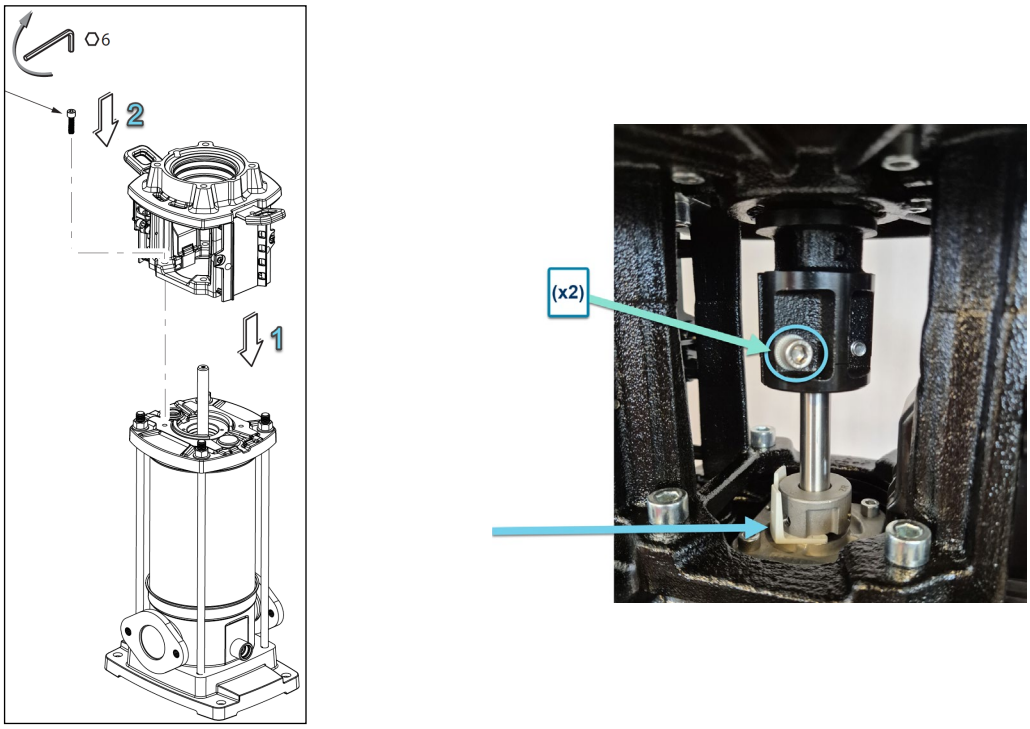


Figure 16 Reassembling the Lantern (x4 screws); Tightening the Coupling screws(x2).

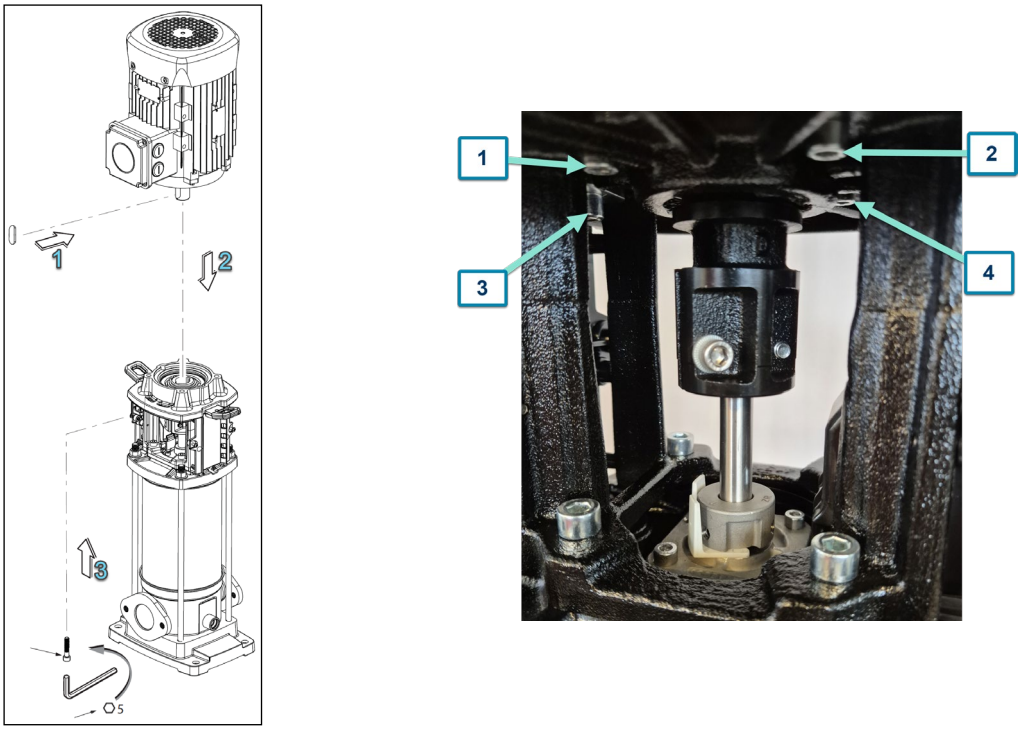


Figure 17 Reassembling the motor; Tightening the motor screws (x4).

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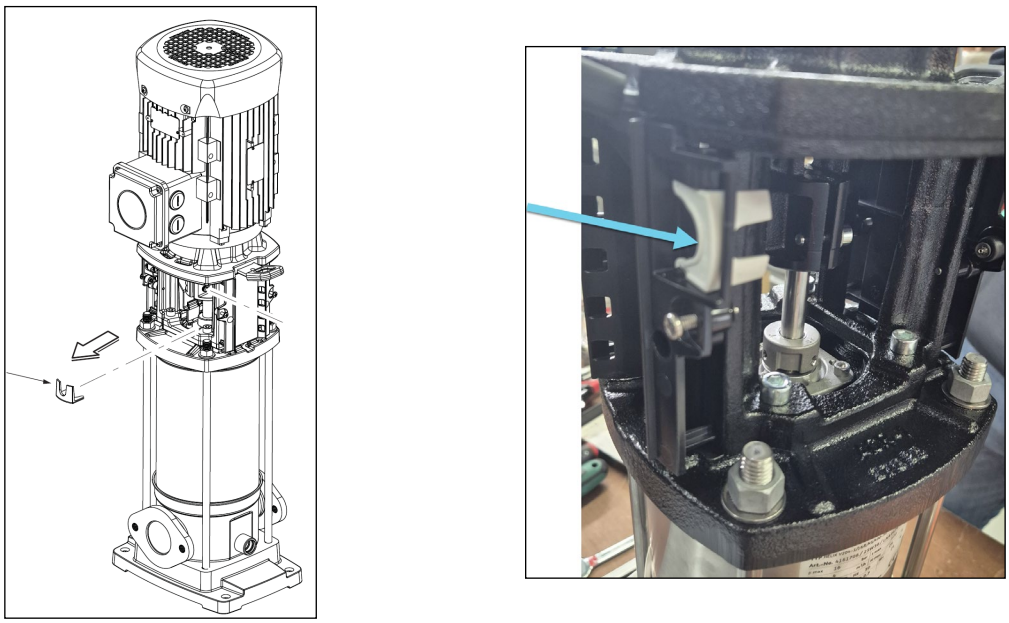


Figure 18 Removing the spacer.



Figure 19 Attaching the Coupling gaurds.

Task Forms

Country: _____ Competitor: _____

1. Pump type: _____
2. Serial number: _____
3. Which components were replaced?

   _____

4. Were any parts damaged or missing before the work?

   _____

5. Was the hydraulic unit dismantled? Yes/No

   _____

6. Is the pump service ready after the workshop task? Yes/No

   _____

7. Remarks (if any): _____

Marking Scheme

The task evaluation will be made according to the Competition Information System (CIS) of Water Technology 2026.

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